Mapping Potential Distribution over Electrically Biased Networks of Conductive Nanowires

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Abstract:

Recently, metal nanowire (NW) networks have extensively been studied as a form used for the transparent electrodes because of their high conductivity and flexibility.[1] Also, NW network is useful as a material for water-filtration system with antibacterial functions because NW produces higher electric field than other structure.[2] In the above applications, local conductance and potential distribution over the NW-network are important factors for their performance. It is, therefore, necessary to investigate electrical properties of complex networks for understanding the mechanism and improving the application performance. In this study, we finally aim at mapping the potential distribution of silver NW (AgNW) in complex networks using KPFM (Kelvin Probe Force Microscope). KPFM would be suitable technique to measure the local potential of AgNW network with high spatial resolution.[3]

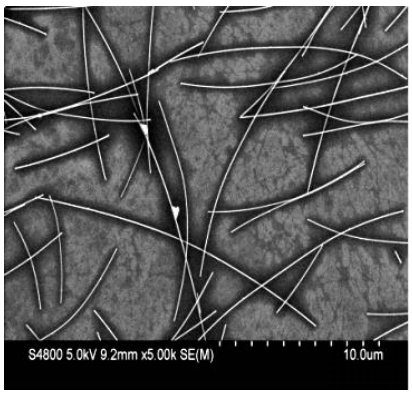

Fig. 1 SEM image of AgNW network deposited on a SiO_2 substrate.

AgNWs were synthesized by “polyol process”. Briefly, 1,2-propyleneglycol containing poly(vinylpyrrolidone) and NaCl was placed in a glass vial. After dropping $AgNO_3$ solution, the glass vial was capped and heated at 130 ºC for 1 h. The AgNW network was prepared by drop-casting of alcohol dispersion on a substrate (Fig. 1). The surface of AgNW is covered with a thin insulating polymer layer. Thus the polymer layer creates a metal/insulator/metal (MIM) junction between nanowires bearing non-linear electrical properties such as resistive switching based on the electromigration of Ag atoms. In this presentation we discuss about potential distribution of AgNW network and the changes induced by applied bias voltage together with benefits and drawbacks of the KPFM measurements.

References:

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